Antennas

BY ARNIE CORO, CO2KK

Connecting Your Station To The World

The TVB: A Two-Sloping-Wires-at-an-Angle Homebrew Signal Booster

A single mast, two sloping wires plus two terminating resistors connected to ground, and an additional wire joining the resistors together will not take too much time to install. Once installed, you will be the proud owner of a Terminated V Beam (TVB), one of the most interesting wire antennas I have ever tested. Of course it is a directional antenna system, but it has the advantage that at least two of them can be installed from a single support structure without too much interaction between antennas pointing in opposite directions. Maximum radiation is in the direction of the center of the two sloping wires.

Wire length: 20 meters (approx. 67 feet)
Wire diameter: at least No. 12
Apex angle: 30 degrees
Height above ground of feedpoint: 15 meters (nearly 50 feet)
Height above ground of terminating resistors : 2 meters (about 6.5 feet)
Value of terminating resistors: 300 ohms (but you can use between 250 and 500 ohms)
Feeder: 450 ohm open-wire line to shack, then connected to 4:1 balun to tuner

Table I– Parameters for a practical 12, 10, and 6 meter band TVB that will also work (with somewhat less efficiency) on 20 and 15.

Why Use a TVB?

Such a simple, easy-to-install antenna is a nice option for contest stations, as it can be set up using a tall tree or a single easily transportable dielectric (non-conductive) mast.

The TVB antenna can be best described by saying that it is made using two sloping wire elements of a certain length, terminated by non-inductive resistors of the same value. The two wires spread out from the dielectric support structure at a certain specific apex angle, and that's one of the important parameters of this antenna system.

The feedpoint of the TVB is located at the top of the mast, at the exact vertex of the two wire radiating elements. You can feed this antenna using a parallel balanced transmission line or a coaxial line, but in the case of coax, you must use a balun.

Some experimenters have tried using a metal tower or mast (conductive structure) as the support, and in that case results do change. There is a way of doing this which may be attractive for those who have a self-supporting tower or one with guy wires broken at appropriate length with insulators. The *apex* of the TVB simply is moved away from the supporting structure a minimum of 1 meter (3.28 feet), and then open-wire transmission line is installed horizontally until it reaches the tower, at which point you can install a balun and continue down to the shack using coaxial cable.

There are certain key TVB design parameters to consider:

1. The length of the radiating elements. (They can be up to several wavelengths long!)
2. The diameter of the radiating elements. (You can improve bandwidth by using more than one wire, or a cage configuration.)
3. The angle formed by the two wires (*apex* angle).
4. The value of the non-inductive terminating resistors.
5. The height of the feedpoint above ground.
6. The height of the terminating resistors above ground.
7. The length of the wire that connects the two terminating resistors (sometimes not used by V beam builders, but found to be very useful for improving the radiation pattern).

Now don't be afraid. I can assure you that the average ham can handle all seven of these antenna parameters to homebrew very effective TVB antennas.

Origins of the TVB

Dr. Jose A. Valladares, Ph.D., now in his late eighties, was the antenna guru who introduced me to the TVB system way back in 1961, when he installed several of them at a commercial HF receiving station. I came to learn about the TVB one day while visiting that pre-satellite-era installation. I observed the sloping wires terminated with carborundum non-inductive resistors located at about 3 meters (approximately 10 feet) above ground level, with a wire going down from those short masts to a ground rod. Another wire joined the two masts and formed a delta-loop-like structure, with the only difference being that the wire linking the two resistors was connected to their ground side, not to the sloping wires. This slanted V configuration, in which the terminating resistors are at a certain height above ground, is much more effective, something that was proven in practice.

Dr. Valladares told me that the great advantage he attributed to the V beam configuration in general and to this specific form of terminated V was its simple installation. He also stated that the flexibility provided by this antenna system was second to none, as he could install several of them using existing masts that supported other commercial receiving antennas such as the fishbone and the rhombics (the log periodic was not yet popular in the early '60s).

For amateur radio installations TVB antennas have an additional advantage in that the sloping wires respond to both the vertical and horizontally polarized waves when receiving and generate mixed polarization when transmitting.

When you design a TVB antenna properly, technically speaking it would be described by the antenna gurus as a traveling-wave antenna, so it will provide users with a rather large operating bandwidth.

The TVB antenna power gain will depend on many parameters, including the operating frequency, ground conductivity, height above ground of the apex, etc.

Try One for 6 Meters!

A typical TVB antenna for the HF bands will require a lot of real estate, as the elements may need to be up to a city block long or even more! However, with minimum sloping element lengths on the order of 20 meters (67 feet), the antenna will work from 14 MHz all the way up to 60 MHz! The effective gain will increase as the frequency goes up, making this par-

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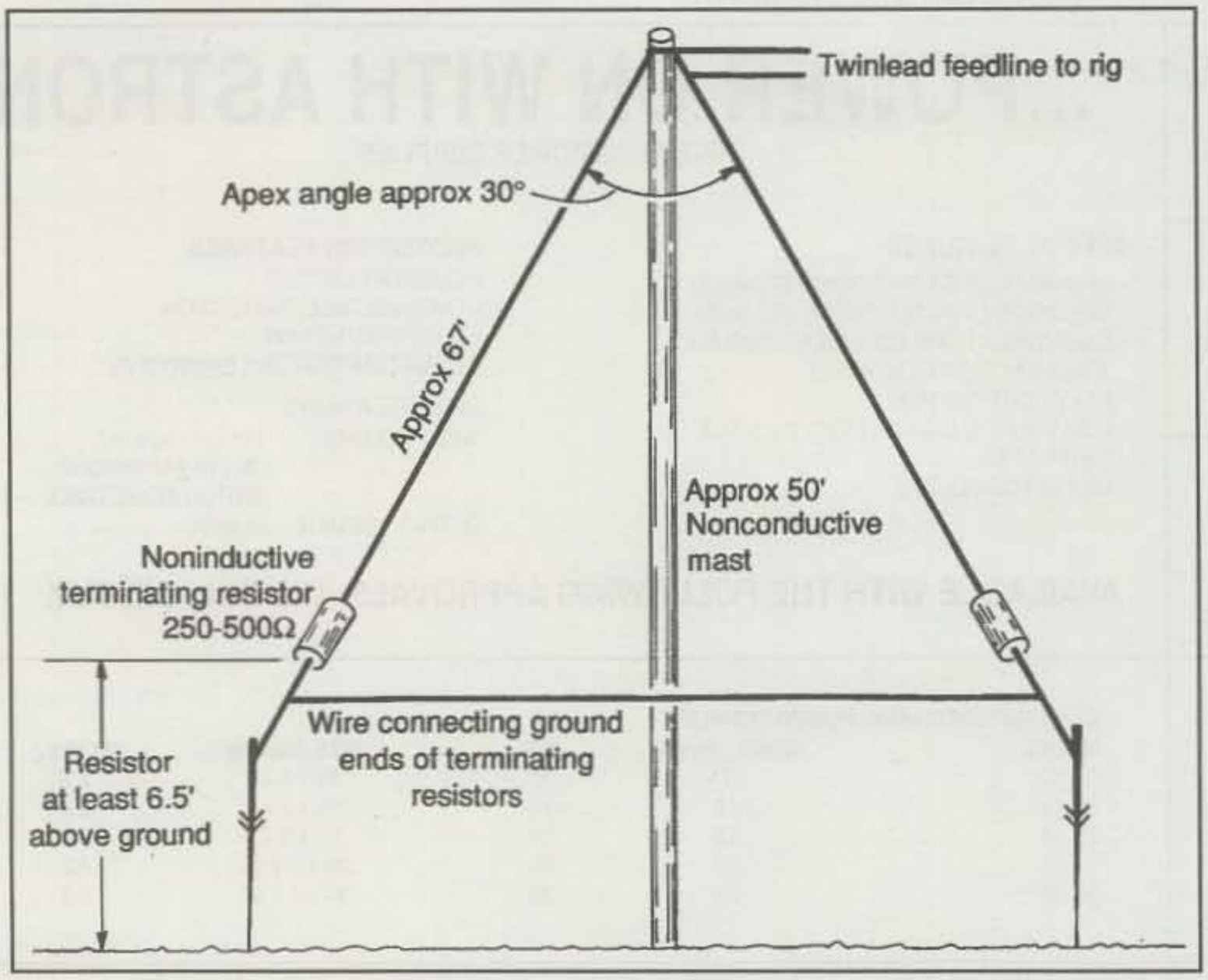

Fig. 1– The Terminated V Beam (TVB) antenna uses two sloping wires from a center feedpoint to non-inductive terminating resistors at least 6.5 feet above ground, with a third wire connecting the ground sides of the two resistors.

ticular TVB configuration especially useful for the 12, 10, and 6 meter bands (see Table I for design parameters).

You will have to choose the optimum apex angle, but in practice, angles between 60 and 30 degrees will produce useful gain and directivity. If you want to favor the higher end of the antenna's frequency range, then *reducing* the apex angle is the way to go.

The terminating resistors connected to the near-ground end of each sloping wire must be non-inductive and capable of dissipating about 30 percent of

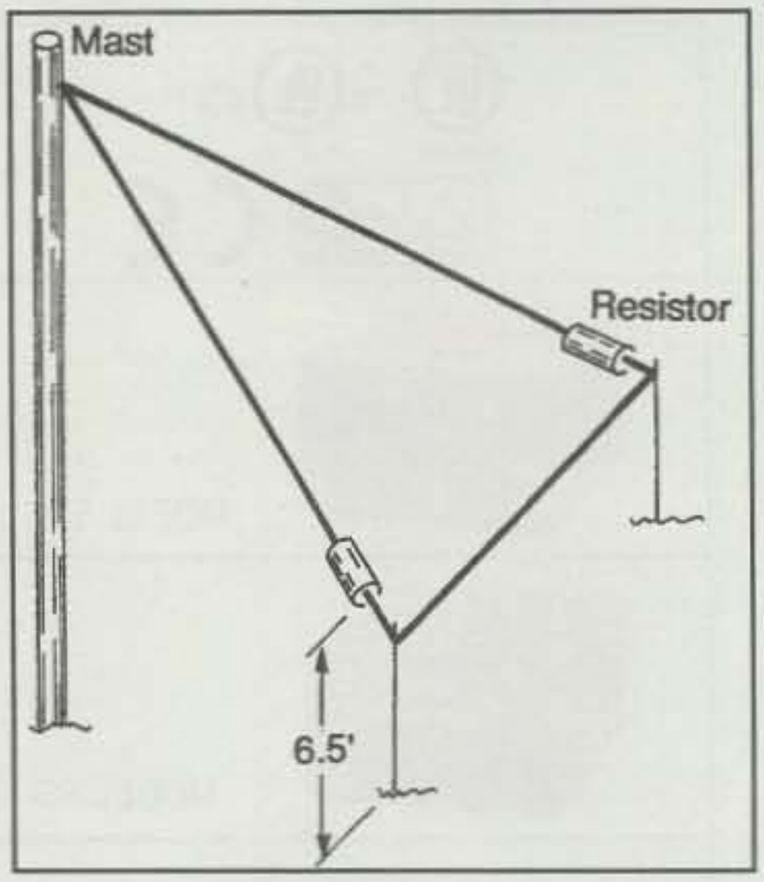

Fig. 2– Side view of the TVB antenna.

the transmitter power if full carrier modes of operation are used. For CW work, with a shorter duty cycle, the resistors may be smaller. For SSB I have used resistors rated for 20 percent of the transmitter power without any signs of overheating problems after many months of constant use.

I have made my own non-inductive resistor assemblies in the 250 to 500 ohm range by connecting series-parallel combinations of 2 watt carbon resistors. The actual value of the terminating resistors is not really important, according to my experimental work here at CO2KK, as the performance of my TVB antennas has proven to be essentially the same with terminating resistor values in that 250 to 500 and even up to 600 ohm range.

Your best option for feeding this low-cost directional antenna is to use open-wire transmission line right to the shack, where a 4:1 balun will allow you to connect it to an antenna tuner.

Start Building!

Antenna experts will provide you with nice graphics to optimize the design of Terminated V Beam antennas, and you can spend quite some time experimenting with different configurations. However, why not start to build the TVB for 12, 10, and 6 meters this weekend, and begin to enjoy operating on those bands with the antenna pointing in the most favorable direction.

My own north-oriented TVB sees a lot of action during the summer *E*-skip season, while the south-pointed TVB keeps me in touch with the many South American 6 and 10 meter operators during the twice yearly transequatorial propagation seasons.

Try the TVB antenna. It is easy to build, costs very little, and works well!

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Terminated Vee Beam

A simple broad band antenna was described in *CQ* magazine for September 2002 by Arnie Coro CO2KK in his *Antennas* column. Arnie CO2KK attributes the antenna to Dr Jose A. Valladares PhD, who showed him how to use it in 1961.

The antenna is a sloping Vee beam supported by a mast of 15 metres (50 ft approx) which slopes down to approx 6.5 feet above ground. The antenna is terminated at the ends and the example described covered the 6, 10, and 12 metre bands and also, with reduced performance, 15 and 20 metres.

The antenna is shown in Fig 6. A side view is shown in Fig 7. Two sloping wires 20 metres long (67 ft approx) slope down from the feed point to terminating resistors two metres (6.5 feet) above ground. The other ends of the terminating resistors are joined by a connecting wire. The resistors are in the range 250 to 500 ohms and should be non-inductive types capable of dissipating around 30 % of the power used. The apex angle is between 30 and 60 degrees. The angle should be closer to 30 degrees if 6 metres is the primary interest, but can be widened toward 60 degrees if the lower bands are of more interest.

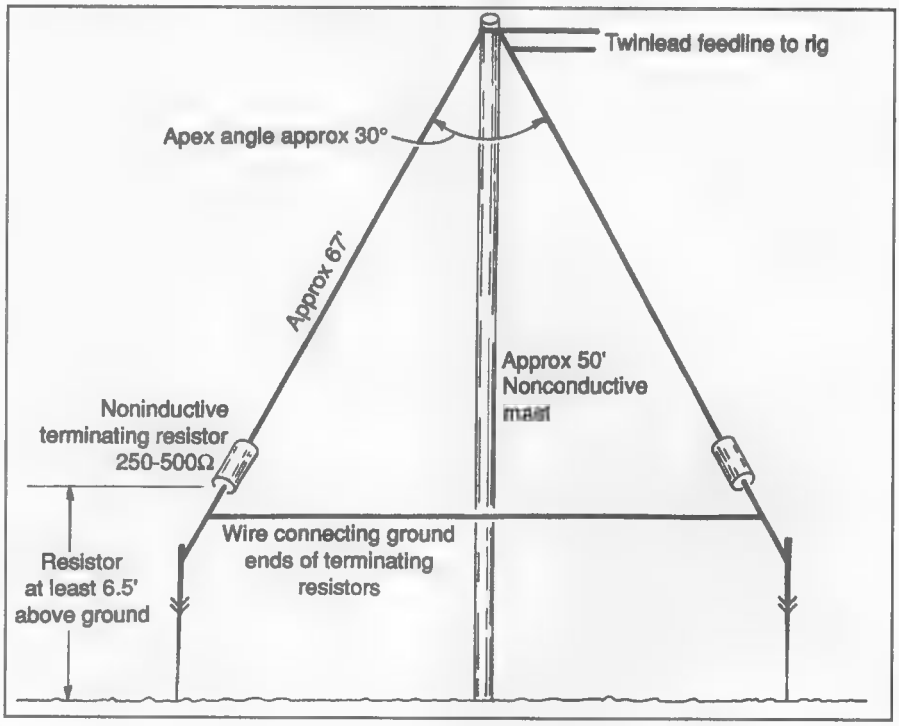

Fig 6. Terminated Vee beam.

The feed line used was 450 ohm open wire line to a 4:1 balun feeding a tuner in the shack. With some experimentation you could probably find a combination of apex angle and terminating resistors which would allow reasonably low SWR operation with a balun at the feed point over a wide frequency range.

Arnie CO2KK has used the antenna for pointing in a favoured direction for 6 metre and 10 metre DX. The antenna beam is in the direction from the mast support through the midpoint of the line between the terminating resistors.

If a metal support mast is used then the apex of the Vee where the feed-point is suspended should be a minimum of one metre from the metal support.

The advantage of this antenna is the wide bandwidth allowing operation or monitoring on a range of frequencies with directivity and some gain.

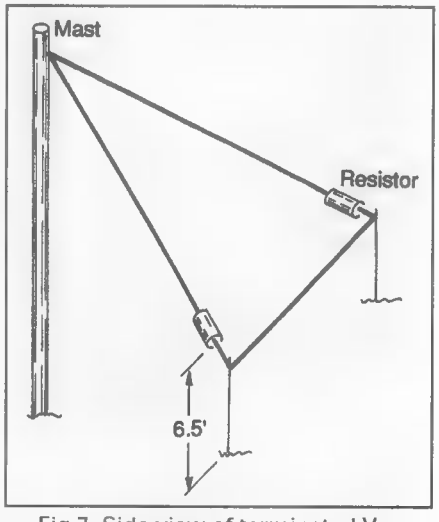

Fig 7. Side view of terminated Vee beam.

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